The two techniques are also complementary as far as the distribution of the seismic velocity is concerned: the NVR yields the information on the velocity of the shallow layers and on its lateral changes, while the DSS give the velocity model in the crystalline and deep crust.

The Adriatic indenter and the"lateral extrusion model": an approach to the Eastern Alps deep structure interpretation

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The Insubric (Periadriatic) Lineament (IL) of the Pustertal and Gailtal zones is a very strong tectonic separation between the S verging thrust belt of the Southern Alps, unaffected by Alpine metamorphism (Africa verging orogenic chain) and the metamorphic nappe building of the Alps characterized by strong tectonic polarity to the N (Europa verging orogenic chain). The lithospheric stuctural relationships of the two facing sectors of the Alps across the Insubric Lineament correspond to the more complex problem of the whole Transalp profile. N of the IL, the European units of the Central Gneiss Zone with their tectonic cover of oceanic meta-sediments and ophiolites of the Tauern Window (TW) structure were affected by strong ductile deformations, dominated by vertical narrow folds where the gneiss are largely prevailing. These units underwent very intense shortening and uplifting, rising up and/or exhuming for 30-35 km in the last 40 Ma (mostly in early-mid Miocene times, between 20 and 15 Ma) (Lammerer and Weger, 1998). Completely different is the deformational Alpine history and structural setting of the zone located to the S of the IL, that is the Italian Dolomites in the eastern Southern Alps. This belt underwent, on the contrary, mostly S-verging thrusting and brittle deformation and only moderate uplifting confirmed by fission tracks investigations in the whole eastern Southern Alpine domain. Moreover these vertical movements occurred in connection with the neo-Alpine strongest compressional events. The dipping in depth of the Insubric Lineament is a key to the solution of the lithospheric setting of the Alps in their axial zone. In the Central and Western Alps, the IL has been mostly considered N and NW dipping after the Argand's structural interpretation (1924). The modern tectonic reconstructions based on the deep seismic reflexion acquisitions in the Central and Western Alps (see for instance Pfiffner et al., 1997) confirmed these deep structural settings. With regards to the Eastern Alps, the IL in depth can been assumed dipping both to the N and to the S. Deep immersions to the N of the IL in the sector crossed by the Transalp Profile, are consistent with the tectonic structures present at the surface along the Puster Valley (e.g. Dal Piaz, 1934). The Transalp reflexion data may be considered coherent with this interpretation. In fact a transparent zone underneath the Tauern window southern side, produce a strong break in the reflective seismic facies which could correspond to the possible N dipping continuation in depth, for some 25 km, of the IL. In this case the IL may correspond to the upper surface of a thick wedge of Adriatic lithosphere indented between the Tauern Window nappe stack and the underlying subducted European units. This interpretation may be considered consistent with the structural setting of the backthrusted Southern Alps belt and with the deep images underneath the TW. Moreover in this frame the lateral and vertical extrusion of the TW structure may be better explained.

Nevertheless, the seismic data across this Lineament in depth show high to middle angle S dipping prominent reflectors, joining the IL at the surface. Similar setting of the IL in depth could support a different general crustal interpretation of this sector of the Alps. In this frame, in fact, the S dipping IL could be seen as the upper surface of a Penninic large indentation of the TW structure inside the Adriatic Plate. This view will be better explaned in a separate presentation by B. Lammerer of our TRANSALP Working Group.

*For the list of the members of the Transalp Working Group see the B. Lammerer's Abstract.

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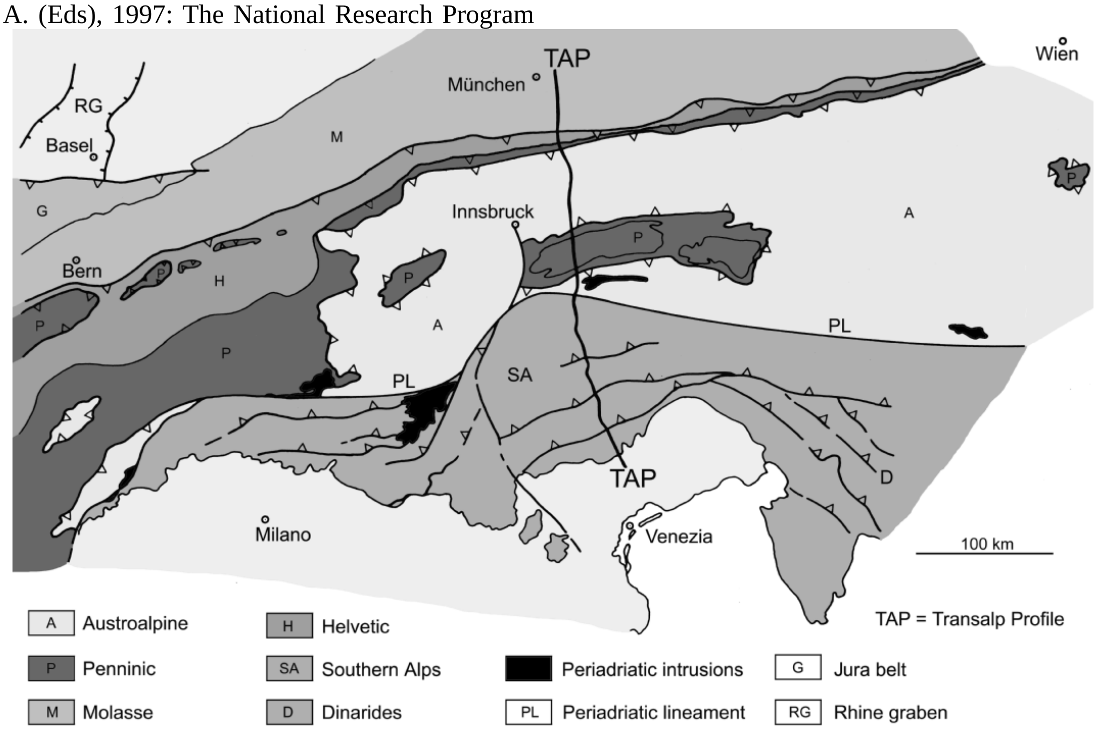

Fig.1 The Transalp Profile location

Influence of shape and the particle/matrix interface conditions on the behaviour of elongated rigid particles in non coaxial flow

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The rotational behaviour of a rigid particle embedded in a linear viscous matrix undergoing a non-coaxial flow was studied in a series of 2D experiments. In particular the influence of particle-shape and the nature of the matrix/particle interface (lubricated versus unlubricated) was investigated.

The experiments were carried out using a ring shear rig, allowing high shear strains. Polyethylene particles were immersed in a polydimethyl-siloxane polymer (PDMS SGM36) and deformed at a shear strain rate of $\gamma \leq 9.10^{-4}$ s^{-1}. Slip boundary conditions were produced using soap with a viscosity 10000 times less than the PDMS. Particles with aspect ratios of 1, 2, 3 and 6 were investigated as well as a particle with monoclinic symmetry (rhomb or parallelopiped) for comparison with previous experiments.

A first series of experiments was carried out using elliptical particles with no slip at the matrix/particle boundary. Under these conditions the behavior of an elliptical particle undergoing simple shear is almost identical to the analytical solution of Jeffery (1922).

In a second series of experiments with elliptical particles, slip was induced at the particle/matrix boundary. Shear strains up to $\gamma = 45$ were reached. The experiments were repeated for each particle, starting with the long axis at different angles of 0°, 30°, 60° and 90° to the shear plane. The introduction of slip at the particle/matrix boundary led to considerable deviation of the measured rotation paths from the theoretical ones. The deviations are especially influenced by the initial orientation of the particle and the amount of the soap present at the matrix/particle boundary.

Concerning the influence of the initial particle orientation, all experiments produced very similar results independently of the aspect ratio. In complete contrast to Jeffery theory, objects initially oriented with the long axis parallel to the shear direction rotate backwards (i.e. antithetically) during the first increments of strain. With increasing strain, the particles temporarily stabilize at an angle between 10° and 20° to the shear plane, depending on the shape of the object. With further strain, all elliptical particles then rotate synthetically with respect to the shear sense. Back rotation was only observed at the